

VOLTAGE DETECTOR

AZ70XX

General Description

The AZ70XX series ICs are under voltage detectors with a built in voltage threshold and low power consumption. The AZ70XX are specifically designed to accurately monitor power supplies.

The AZ70XX use a precision on-chip voltage reference and a comparator to measure the input operating voltage. These ICs can accurately reset the system after detecting voltage at the time of switching power on and instantaneous power off in various CPU systems and other logic systems. The detect voltage thresholds are 2.3V/2.5V/2.7V/2.9V/3.1V/3.3V/4.2V/4.5V for AZ7023/25/27/29/31/33/42/45 respectively. Built in hysteresis helps to prevent erratic operation in the presence of noise.

The AZ70XX series are available in 2 standard packages: TO-92 (bulk or ammo packing) and SOT-89-3.

Features

- Low Current Consumption:
 $I_{CCL}=300\mu A$ Typical
 $I_{CCH}=30\mu A$ Typical
- Low Minimum Operating Voltage for Output Resetting: 0.8V Typical
- Built in Hysteresis Voltage: 50mV Typical
- Open Collector Output
- Extended Temperature Range: -40 to 85°C

Applications

- Low Battery Voltage Detector
- Power Fail Indicator
- Processor Reset Generator
- Battery Backup Control
- Home Electric Appliances

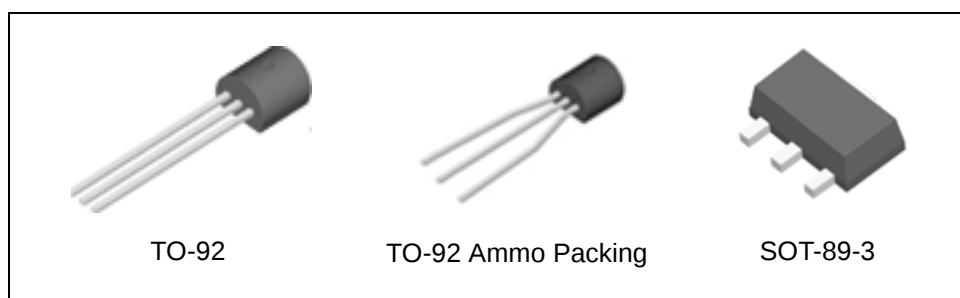


Figure 1. Package Types of AZ70XX

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Pin Configuration

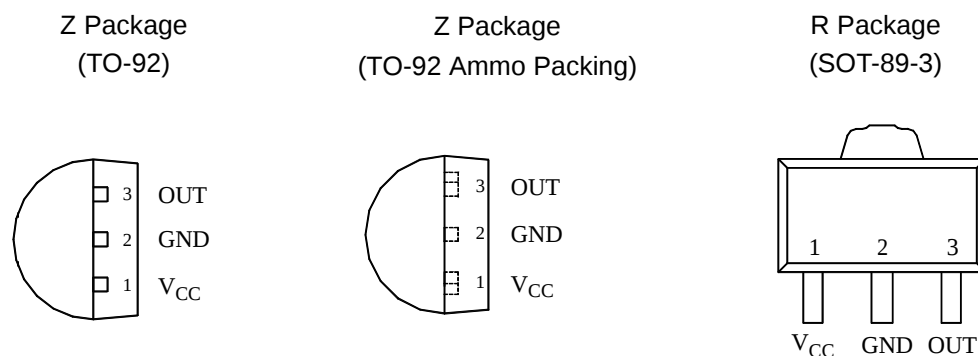


Figure 2. Pin Configuration of AZ70XX (Top View)

Functional Block Diagram

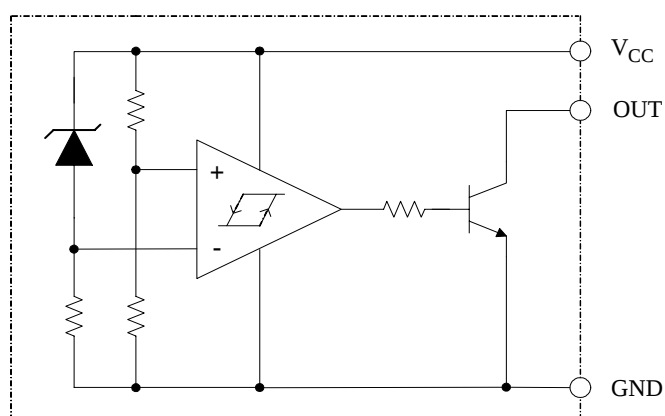
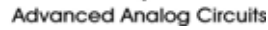


Figure 3. Functional Block Diagram of AZ70XX



AZ70 □ □ □ - □

Circuit Type E1: Lead Free
Blank: Tin Lead

Detect Voltage TR: Tape and Reel or Ammo
Blank: Bulk

23: 2.3V 31: 3.1V
25: 2.5V 33: 3.3V
27: 2.7V 42: 4.2V
29: 2.9V 45: 4.5V

Package
Z: TO-92
R: SOT-89-3

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

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Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.3 to 20	V
Power Dissipation (Package Limitations, $T_A=25^{\circ}\text{C}$)	P_D	TO-92 Package: 400	mW
		SOT-89-3 Package: 500	
Operating Junction Temperature	T_J	150	$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}	-65 to 150	$^{\circ}\text{C}$

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}		18	V
Operating Temperature Range	T_A	-40	85	$^{\circ}\text{C}$

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Electrical Characteristics

T_A=25°C, unless otherwise specified.

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Detect Voltage	V _{DET}	R _L =200Ω (Note 2) V _{OL} ≤ 0.4V	AZ7023R/Z	2.15	2.3	2.45	V
			AZ7025R/Z	2.35	2.5	2.65	
			AZ7027R/Z	2.55	2.7	2.85	
			AZ7029R/Z	2.75	2.9	3.05	
			AZ7031R/Z	2.95	3.1	3.25	
			AZ7033R/Z	3.15	3.3	3.45	
			AZ7042R/Z	4.05	4.2	4.35	
			AZ7045R/Z	4.35	4.5	4.65	
Low-level Output Voltage	V _{OL}	V _{CC} =V _{DET} (min)-0.05V R _L =200Ω (Note 2)				0.4	V
Output Leakage Current	I _{OH}	V _{CC} =15V				0.1	μA
Hysteresis Voltage	V _{HYS}	R _L =200Ω (Note 2)		30	50	100	mV
Detect Voltage Temperature Coefficient	ΔV _{DET} /(V _{DET} × ΔT)	R _L =200Ω (Note 2)			±0.01		% /°C
Circuit Current at On Time	I _{CCL}	V _{CC} =V _{DET} (min)-0.05V			300	500	μA
Circuit Current at Off Time	I _{CCH}	V _{CC} =5.25V			30	50	μA
Minimum Operating Voltage	V _{OPR}	R _L =200Ω (Note 2) V _{OL} ≤ 0.4V			0.8		V
“L” Transmission Delay Time	tpHL	V _{CC} changed from 5.25V to V _{DET} (min)-0.05V, R _L =1.0KΩ, C _L =100p (Note 3)			10		μs
“H” Transmission Delay Time	tpLH	V _{CC} changed from V _{DET} (min)-0.05V to 5.25V, R _L =1.0KΩ, C _L =100p (Note 3)			15		μs
Output Current at On Time	I _{OL} I	V _{CC} =V _{DET} (min)-0.05V T _A =25°C (Note 4)		20			mA
	I _{OL} II	V _{CC} =V _{DET} (min)-0.05V T _A =-40 to 85 °C (Note 4)		16			

Note 2: See test circuit 1 and Figure 12.

Note 3: See test circuit 2 and Figure 12.

Note 4: See test circuit 3. Adjusting the regulative power source until the reading value of voltage meter V is 0.4V, the reading value of current meter A is defined as "Output Current at On Time".

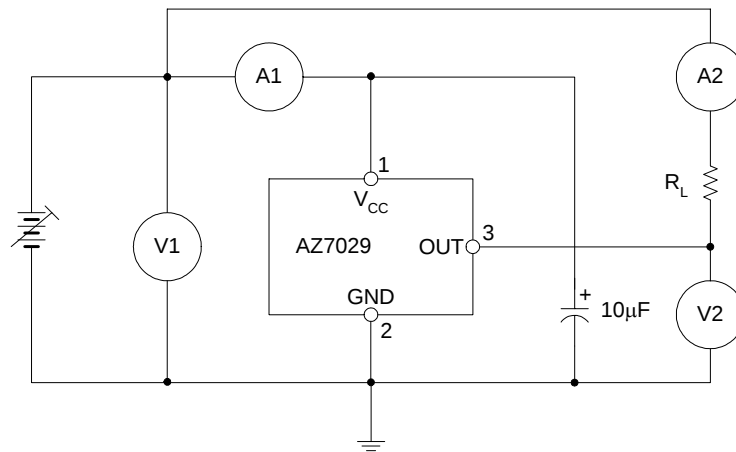
**VOLTAGE DETECTOR****AZ70XX****Electrical Characteristics (Continued)**

Figure 4. Test Circuit 1

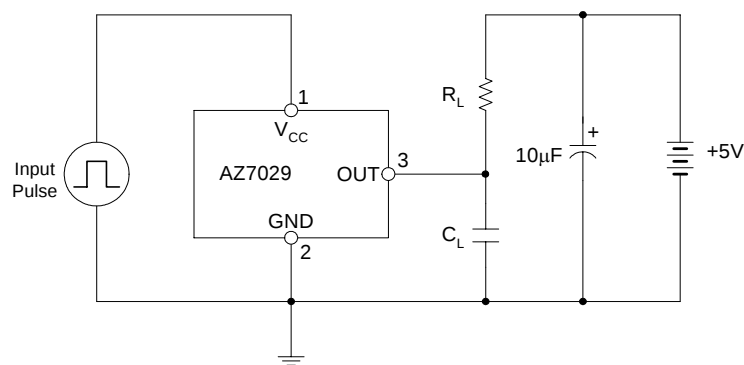


Figure 5. Test Circuit 2

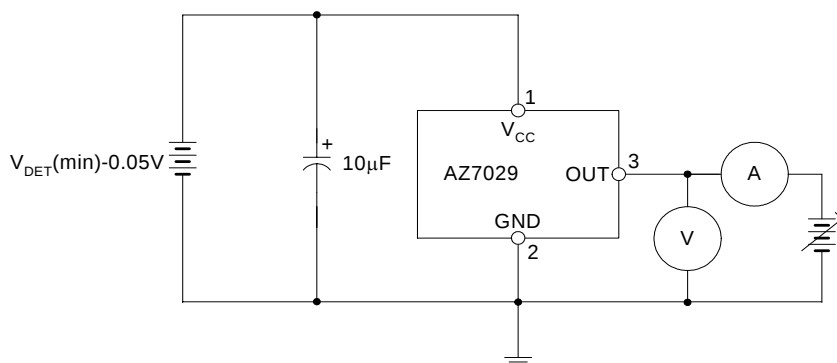


Figure 6. Test Circuit 3

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Typical Performance Characteristics

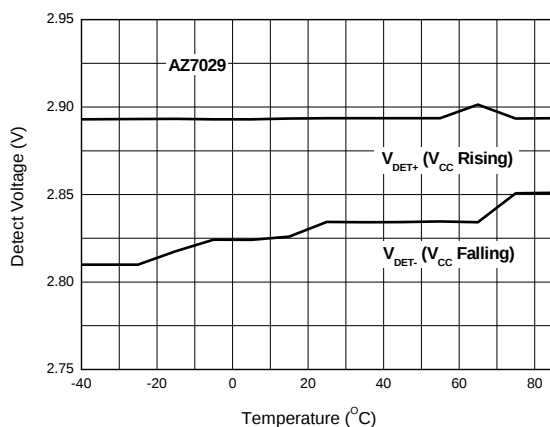


Figure 7. Detect Voltage vs. Temperature

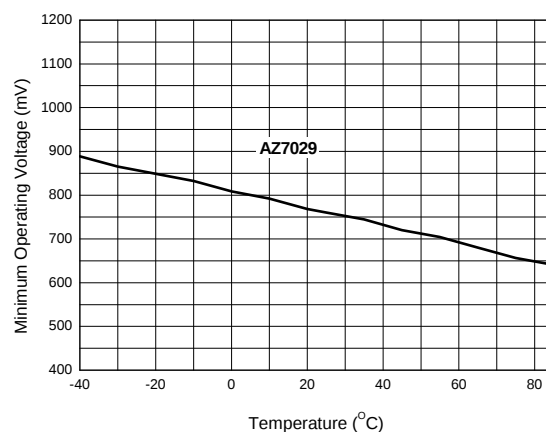


Figure 8. Minimum Operating Voltage vs. Temperature

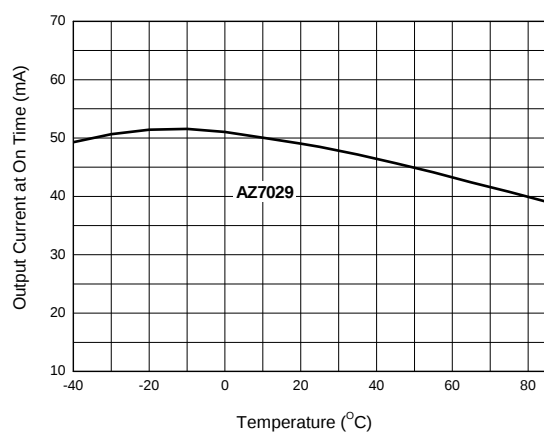


Figure 9. Output Current at On Time vs. Temperature

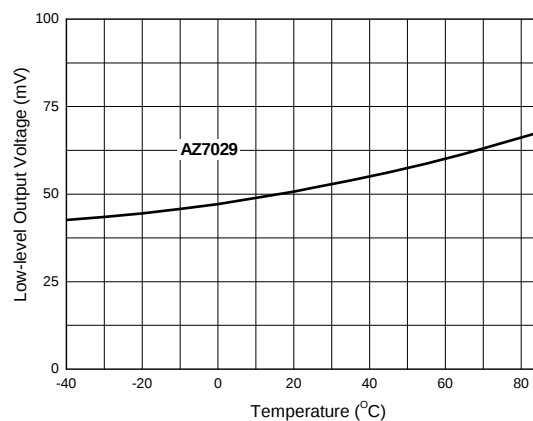


Figure 10. Low-level Output Voltage vs. Temperature

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Typical Performance Characteristics (Continued)

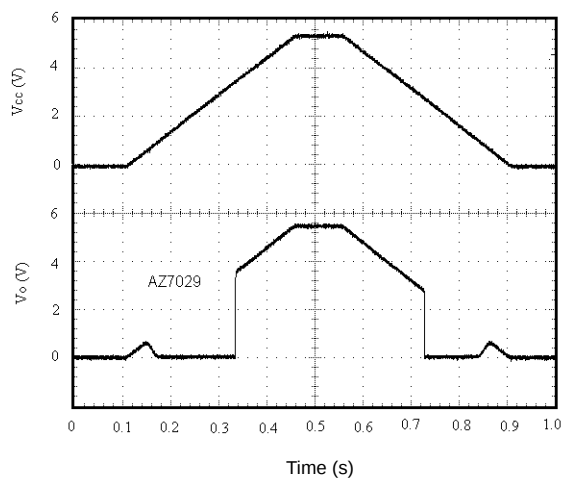


Figure 11. Output Voltage Dynamic Response when V_{CC} Increases and Decreases

Operating Diagram

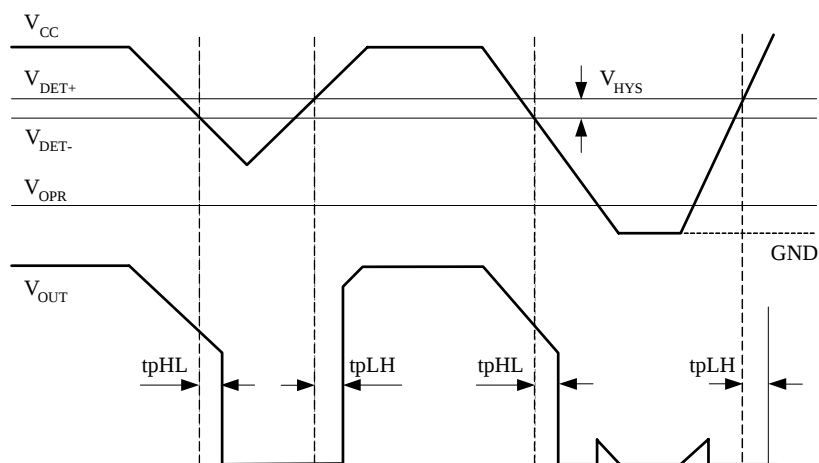


Figure 12. AZ70XX Timing Waveform (Note 5)

Note 5: Detect voltage: V_{DET-}

Hysteresis voltage (V_{HYS}): $V_{DET+} - V_{DET-}$

Release voltage: V_{DET+}

Minimum operating voltage: V_{OPR}

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Operating Diagram (Continued)

Figure 12 is a typical timing waveform for AZ70XX. In normal steady-state operation when $V_{CC} > V_{DET-}$, the output will be in a logic high state and V_{OUT} is dependent upon the voltage that the pull-up resistor connected to.

Here is some explanations for AZ70XX's operation.

1. When the input voltage V_{CC} falls below V_{DET-} , the output will pull down to logic low after a delay time of tp_{HL} . In general, at rated output current and V_{CC} , V_{OUT} can be pulled down to a voltage as low as within 0.4V from GND. (See the Electrical Characteristics section). The voltage level V_{DET-} means the detect voltage.

2. The output, V_{OUT} , will stay valid until V_{CC} falls below the minimum operating voltage, V_{OPR} (0.8V

typical). Below minimum operating voltage, the output is undefined.

3. During power-up, V_{OUT} will remain undefined until V_{CC} rises above V_{OPR} , at which time the output will become valid. V_{OUT} will be in its active low state while $V_{OPR} < V_{CC} < V_{DET+}$ ($V_{DET+} = V_{DET-} + V_{HYS}$). V_{DET+} is the release voltage. V_{HYS} means the hysteresis voltage and is the difference voltage between the V_{DET+} and V_{DET-} .

4. When V_{CC} rises above V_{DET+} , the output will be in its inactive state. After a delay time of tp_{LH} , V_{OUT} will be in its logic high state.

Typical Applications

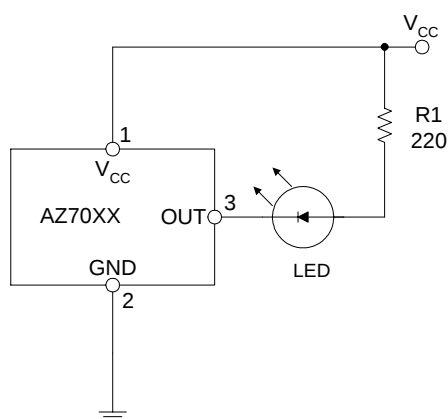


Figure 13. Low Voltage Indicator

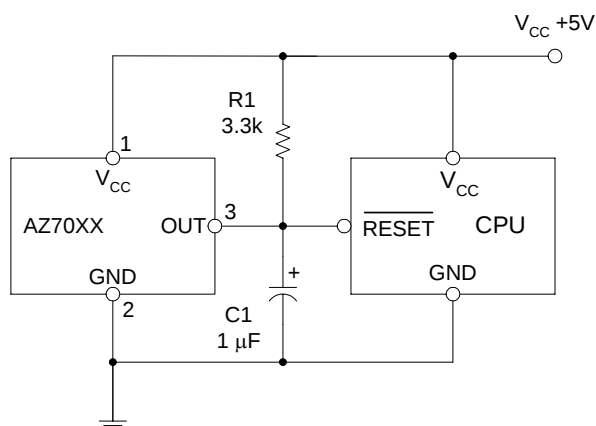
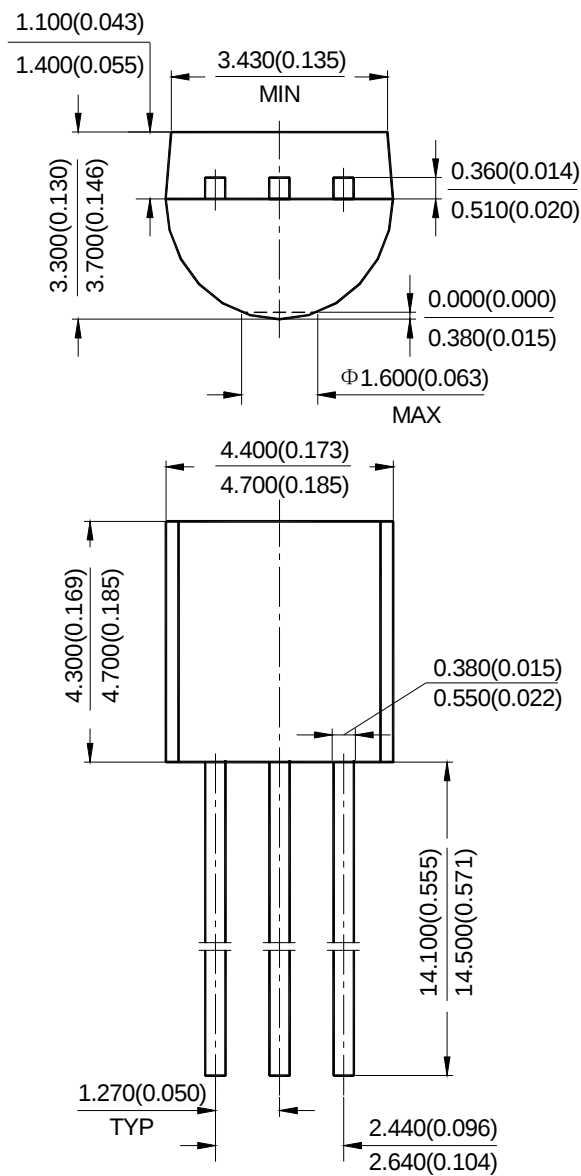
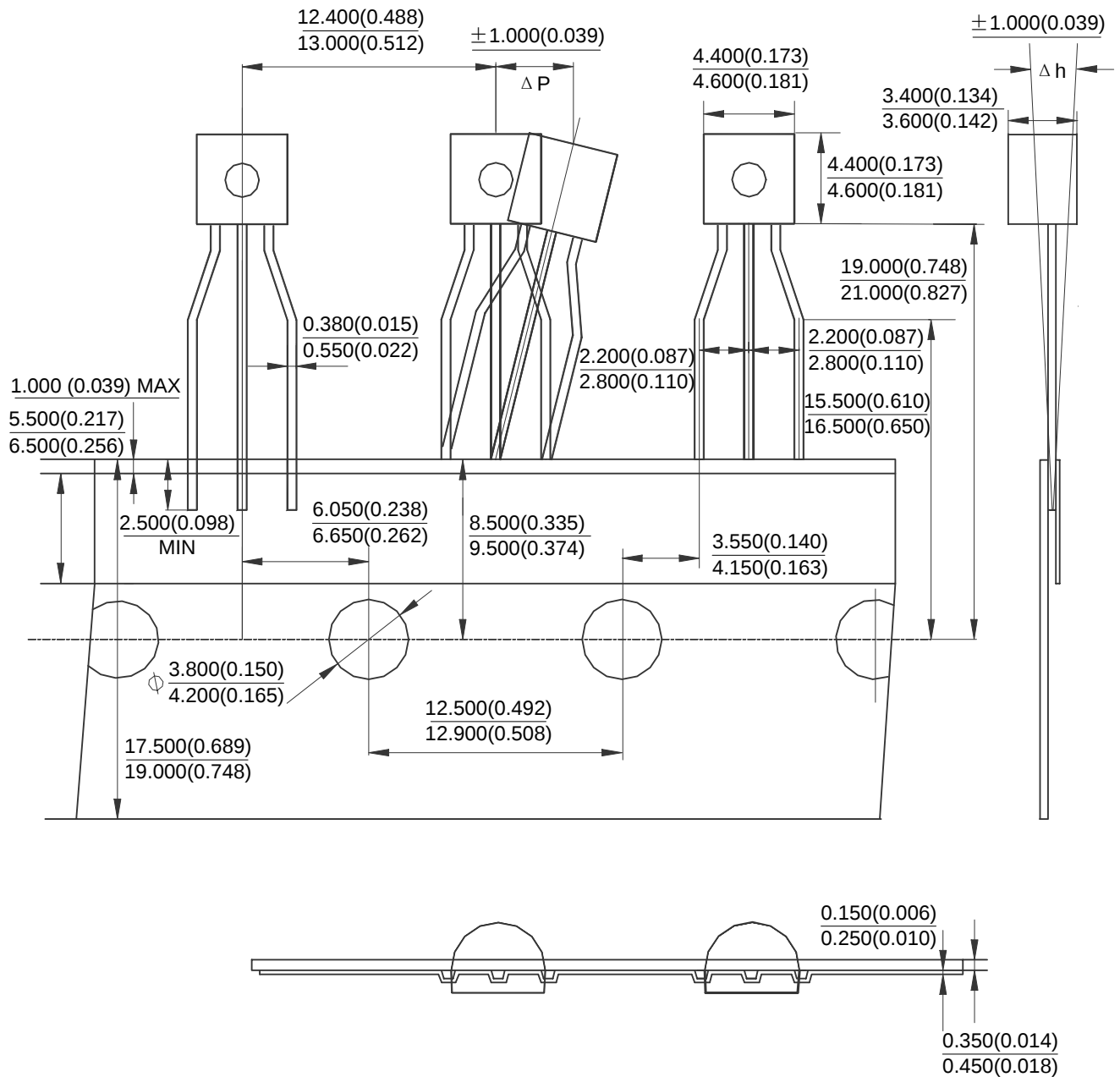
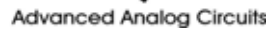


Figure 14. CPU Resetting Circuit

**VOLTAGE DETECTOR****AZ70XX****Mechanical Dimensions****TO-92****Unit: mm(inch)**

**VOLTAGE DETECTOR****AZ70XX****Mechanical Dimensions (Continued)****TO-92 Ammo Packing****Unit: mm(inch)**



SOT-89-3

Technical drawing of a mechanical part, showing three views: front, side, and bottom. Dimensions are given in millimeters (mm) with tolerances in parentheses.

Front View Dimensions:

- Overall width: 4.600(0.181)
- Slot width: 1.830(0.072)
- Slot depth: 1.400(0.055)*
- Slot width at top: 1.630(0.064)
- Slot width at bottom: 1.400(0.055)*
- Overall height: 3.950(0.156)
- Height from base to top of slot: 4.250(0.167)
- Height from base to bottom of slot: 0.900(0.035)
- Height from base to top of block: 1.200(0.047)
- Height from base to bottom of block: 2.300(0.091)
- Height from base to top of block: 2.600(0.102)
- Radius of block corners: R0.200(0.008)
- Width of base: 0.360(0.014)
- Width of base: 0.520(0.020)
- Width of base: 0.360(0.014)
- Width of base: 0.480(0.019)
- Width of base: 0.440(0.017)
- Width of base: 0.560(0.022)
- Overall width of base: 3.000(0.118)

Side View Dimensions:

- Overall width: 1.600(0.063)
- Width of base: 0.360(0.014)
- Width of base: 0.440(0.017)
- Angle: 3°
- Angle: 10°

Bottom View Dimensions:

- Overall width: 3.000(0.118)
- Width of base: 0.360(0.014)
- Width of base: 0.480(0.019)
- Width of base: 0.440(0.017)
- Width of base: 0.560(0.022)
- Overall width of base: 3.000(0.118)
- Radius of block corners: R0.150(0.006)
- Angle: 3°
- Angle: 10°



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MAIN SITE

BCD Semiconductor Manufacturing Limited

- Wafer Fab

Shanghai SIM-BCD Semiconductor Manufacturing Limited

800, Yi Shan Road, Shanghai 200233, China

Tel: +86-21-6485 1491, Fax: +86-21-5450 0008

REGIONAL SALES OFFICE

Shenzhen Office

Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd. Shenzhen Office

Advanced Analog Circuits (Shanghai) Corporation Shenzhen Office

Room E, 5F, Noble Center, No.1006, 3rd Fuzhong Road, Futian District, Shenzhen 518026, China

Tel: +86-755-8826 7951

Fax: +86-755-8826 7865

BCD Semiconductor Manufacturing Limited

- IC Design Group

Advanced Analog Circuits (Shanghai) Corporation

8F, Zone B, 900, Yi Shan Road, Shanghai 200233, China

Tel: +86-21-6495 9539, Fax: +86-21-6485 9673

Taiwan Office

BCD Semiconductor (Taiwan) Company Limited

4F, 298-1, Rui Guang Road, Nei-Hu District, Taipei,

Taiwan

Tel: +886-2-2656 2808

Fax: +886-2-2656 2806

USA Office

BCD Semiconductor Corporation

30920 Huntwood Ave. Hayward,

CA 94544, U.S.A

Tel : +1-510-324-2988

Fax: +1-510-324-2788



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Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.